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(54) METAL VAPOR DEPOSITED ALUMINUM FOIL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide excellent adhesion with a metal vapor depositing layer, on the surface of aluminum foil, by forming a metal vapor depositing layer with nuclei under plasma discharge and forming a metal vapor depositing layer thereon.

SOLUTION: Preferably, the plasma discharge intensity is controlled to ≥6.7 W.min./m2, discharge gas in the plasma discharge is composed of oxygen, and both metals in the metal vapor depositing layer with nuclei under plasma discharge and the metal vapor depositing layer are composed of copper. Desirably, the average film thickness of the metal vapor depositing layer with nuclei is ≥0.01 nm, and the average film thickness of the metal vapor depositing layer is 5 to 150 nm. The aluminum foil is stuck foil obtd. by sticking the opposite face of the metal vapor depositing face of the aluminum foil with a plastic sheet or a plastic film, coated foil obtd. by coating the opposite face of the metal vapor depositing face of the aluminum foil with a polymer or colored foil or printed foil obtd. by coloring or printing the opposite face of the metal vapor depositing face in the aluminum foil, and its thickness is preferably controlled to 6 to 200 μm.

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CLAIMS

[Claim(s)]
[Claim 1] Metal vacuum evaporationo aluminium foil which makes it come, respectively the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge, and on it to form a metal vacuum evaporationo layer on an aluminium foil front face.
[Claim 2] Metal vacuum evaporationo aluminium foil according to claim 1 characterized by the reinforcement of plasma discharge being more than 6.7 W-min./m2.
[Claim 3] Claim 1 characterized by the discharge gas of plasma discharge being oxygen, or metal vacuum evaporationo aluminium foil according to claim 2.
[Claim 4] Metal vacuum evaporationo aluminium foil according to claim 1 to 3 characterized by the metal of the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge being copper.
[Claim 5] Metal vacuum evaporationo aluminium foil according to claim 1 to 4 characterized by the metal of a metal vacuum evaporationo layer being copper.
[Claim 6] Metal vacuum evaporationo aluminium foil according to claim 1 to 5 characterized by the average thickness of a metal vacuum evaporationo layer with a nucleus being 0.01nm or more.
[Claim 7] Metal vacuum evaporationo aluminium foil according to claim 1 to 6 characterized by the average thickness of a metal vacuum evaporationo layer being 5nm - 150nm.
[Claim 8] Metal vacuum evaporationo aluminium foil according to claim 1 to 7 characterized by performing formation of the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge, and a metal vacuum evaporationo layer under the same vacuum.
[Claim 9] Metal vacuum evaporationo aluminium foil according to claim 1 to 8 characterized by being the spreading foil with which aluminium foil applied a sheet plastic or plastic film to the opposite side of the metal vacuum evaporationo side of aluminium foil, and applied the polymer to the opposite side of the metal vacuum evaporationo side of lamination ******** and aluminium foil, the coloring foil which colored or printed the opposite side of the metal vacuum evaporationo side of aluminium foil, or a printing foil, and the thickness being 6-200 micrometers.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the metal vacuum evaporationo aluminium foil characterized by making strong adhesion give by improvement in the adhesion force of a metal vacuum evaporationo layer about metal vacuum evaporationo aluminium foil.
[0002]
[Description of the Prior Art] Generally the aluminium foil which carried out metal vacuum evaporationo has the fault that adhesion with a metal vacuum evaporationo layer is not good in an aluminium foil front face. Although the method of processing annealing, pickling, etc. on aluminium foil beforehand was learned as an approach of raising this adhesion force before carrying out metal vacuum evaporationo, there was a difficulty that the adhesion force does not improve greatly.
[0003]
[Problem(s) to be Solved by the Invention] This invention is to offer the metal vacuum evaporationo aluminium foil excellent in adhesion with a metal vacuum evaporationo layer.
[0004]
[Means for Solving the Problem] The above-mentioned purpose of this invention was industrially attained advantageously by following this invention as a result of wholeheartedly examination of this invention persons.
[0005] [1] Metal vacuum evaporationo aluminium foil which makes it come, respectively the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge, and on it to form a metal vacuum evaporationo layer on an aluminium foil front face.
[0006] [2] Metal vacuum evaporationo aluminium foil of the above-mentioned [1] publication characterized by the reinforcement of plasma discharge being more than 6.7 W-min./m2.
[0007] [3] The above [1] characterized by the discharge gas of plasma discharge being oxygen, or metal vacuum evaporationo aluminium foil given in [2].
[0008] [4] Metal vacuum evaporationo aluminium foil given in either of above-mentioned [1] - [3] characterized by the metal of the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge being copper.
[0009] [5] Metal vacuum evaporationo aluminium foil given in either of above-mentioned [1] - [4] characterized by the metal of a metal vacuum evaporationo layer being copper.
[0010] [6] Metal vacuum evaporationo aluminium foil given in either of above-mentioned [1] - [5] characterized by the average thickness of metal vacuum evaporationo **** with a nucleus being 0.01nm or more.
[0011] [7] Metal vacuum evaporationo aluminium foil given in either of above-mentioned [1] - [6] characterized by the average thickness of a metal vacuum evaporationo layer being 5nm - 150nm.
[0012] [8] Metal vacuum evaporationo aluminium foil given in either of above-mentioned [1] - [7] characterized by performing formation of the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge, and a metal vacuum evaporationo layer under the same vacuum.

[0013] [9] aluminium foil -- aluminium foil -- a metal -- vacuum evaporationo -- a field -- opposite -- a field -- a sheet plastic -- or -- plastic film -- lamination -- ******** -- aluminium foil -- a metal -- vacuum evaporationo -- a field -- opposite -- a field -- a polymer -- having applied -- spreading -- a foil -- or -- aluminium foil -- a metal -- vacuum evaporationo -- a field -- opposite -- a field -- coloring -- or -- having printed -- coloring -- a foil -- or -- printing -- a foil -- it is -- the -- thickness -- six - 200 -- micrometer -- it is -- things -- the description -- ** -- carrying out -- the above -- [-- one --] - -- [-- eight --] -- either -- a publication -- a metal -- vacuum evaporationo -- aluminium foil .

[0014] Average thickness has the greatest description of this invention in the metal vacuum evaporationo layer with a nucleus by the bottom of plasma discharge, and the point which is made to form a metal vacuum evaporationo layer with a nucleus 0.01nm or more, and is formed on it and which made the adhesion force between the metal vacuum evaporationo layer of 5-150nm of average thickness, and aluminium foil improve preferably preferably on an aluminium foil front face.

[0015]

[Embodiment of the Invention] Next, this invention is explained in detail.

[0016] In this invention, the spreading foil which applied a sheet plastic or plastic film to the opposite side of the metal vacuum evaporationo side of not only an aluminium foil simple substance but aluminium foil, and applied the polymer to the opposite side of the metal vacuum evaporationo side of lamination ******** and aluminium foil, the coloring foil which colored or printed the opposite side of the metal vacuum evaporationo side of aluminium foil, or a printing foil is used as aluminium foil. The thickness is usually 6-200 micrometers.

[0017] The metal vacuum evaporationo with a nucleus under the plasma discharge in this invention is usually performed as follows. That is, the current which is a 0.1-100Pa ambient atmosphere preferably, and was supplied from the RF generator in the oxygen gas ambient atmosphere is made to discharge between the cathode of a magnetron electrode, and an anode. The copper which constitutes a metal vacuum evaporationo layer with a nucleus is used for a cathode in that case. A gas cation can draw near to a cathode and the spatter of the cathode metal is carried out. The metal by which the spatter was carried out adheres to aluminium foil, and forms a metal vacuum evaporationo layer with a nucleus. That it is 0.01nm or more is the point which makes the adhesion force between a metal vacuum evaporationo layer and aluminium foil improve, and the average thickness of a metal vacuum evaporationo layer with a nucleus has it. [desirable] As for the reinforcement of plasma discharge, it is desirable that it is more than 6.7 W-min./m2. Under the present circumstances, when discharge reinforcement is smaller than 6.7W-min. / m2, the average thickness of the metal vacuum evaporationo layer with a nucleus which adheres on aluminium foil will be set to less than 0.01nm, therefore the surface treatment effectiveness of plasma electrodischarge treatment over aluminium foil will decrease.

[0018] As a metal of a metal vacuum evaporationo layer with a nucleus, although copper, silver, tin, nickel, chromium, etc. are mentioned, copper is desirable.

[0019] Moreover, although there is especially no limit as a metal of the metal vacuum evaporationo layer formed on a metal vacuum evaporationo layer with a nucleus, copper, silver, nickel, tin, chromium, etc. are mentioned. Especially, vacuum evaporationo fitness to copper is the most desirable. Although especially the vacuum evaporationo approach is not restricted, vacuum evaporation technique, the ion plating method, the sputtering method, the ion beam method, etc. are used.

[0020] The average thickness of this metal vacuum evaporationo layer may usually be 5nm - 150nm. Moreover, after the metal vacuum evaporationo stratification with a nucleus, since the direction performed under the same vacuum is improvement in adhesion, without exposing the front face to atmospheric air, formation of the metal vacuum evaporationo layer on a metal vacuum evaporationo layer with a nucleus is desirable.

[0021] The metal vacuum evaporationo aluminium foil of this invention is suitably used as for example, the object for wire coverings, and an object for covering of the coaxial cable of a personal computer.

[0022]

[Example] Hereafter, although an example explains this invention in more detail, this invention is not limited to these.

[0023] In addition, the adhesion reinforcement in an example and the example of a comparison was measured as follows.
[0024] It is dry in urethane system 2 liquid type adhesives to a vacuum evaporationo side, the coat of 2 micrometers is carried out, and it laminates with 25-micrometer non-extended PP film, and ages in 40-degree-C ambient atmosphere for 18 hours. Then, it cut off to 15mm width-of-face x200mm length, and peel strength when 90 degrees exfoliates a metal vacuum evaporationo layer in speed-of-testing 300 mm/min. using the tensilon universal testing machine by the cage en tech company was made into adhesion reinforcement.
[0025] - [example 5] and [example 1 of comparison] - [the example 3 of a comparison] [of [an example 1]]
The copper material of 99.9% of purity is used for the cathode of a 1.5m 6.7 W-min./m2 magnetron electrode under 0.1Pa vacuum with the vacuum evaporationo machine of the usual Rolle Rolle mold, using the pasting article (an adhesives layer being 2 micrometers) of aluminium foil (7 micrometers) with a 1000mm width of face and a thickness of 15 micrometers and polyester film (6 micrometers) as aluminium foil, and oxygen 0.5 l/min. is supplied in a discharge ambient atmosphere. Furthermore, the electrical potential difference was applied to the magnetron electrode, and the metal vacuum evaporationo layer with a nucleus of the average thickness shown in Table 1, respectively was formed on the aluminum foil surface in the plasma discharge ambient atmosphere of each discharge reinforcement shown in Table 1. 50nm of copper vacuum evaporationo layers was made to form by line speed 100 m/min. under the 0.01Pa same vacuum succeedingly. These were made into the example 1 - the example 5.
[0026]
[Table 1]
表1

放電強度 (W・min./m²)	電極にかかる電力 (W)	被付金属蒸着層の平均厚み (nm)
6.7	1000	0.01
13.3	2000	0.05
23.3	3500	0.10
40.0	6000	1.00
56.7	8500	2.00

＊放電強度は次の計算式により算出した。

$$\text{放電強度} = \frac{[\text{電極にかかる電力 (W)}]}{[\text{電極幅 (1.5m)}] \times [\text{ラインスピード (100m/min.)}]}$$

On the other hand, the example 1 of a comparison made the 50nm copper vacuum evaporationo layer form, without forming a metal vacuum evaporationo layer with a nucleus. Moreover, after not making a metal vacuum evaporationo layer with a nucleus form but returning aluminium foil / polyester film pasting article into a plasma discharge ambient atmosphere at through and atmospheric pressure, the 50nm copper vacuum evaporationo layer was made to form under a 0.01Pa vacuum again in the example 2 of a comparison. Copper was formed by the resistance heating method, the metal vacuum evaporationo layer with a nucleus was formed by the thickness of 1.0nm, and the 50nm copper vacuum evaporationo layer was made to form under the same vacuum in the example 3 of a comparison.
[0027] The measurement result of the property of examples 1-5 and the examples 1-3 of a comparison was summarized in Table 2.

[0028]
[Table 2]

表2

	放電ガス	放電強度 (W・min./m²)	核付金属蒸着層の平均厚み (nm)	金属蒸着層の平均厚み (nm)	銅蒸着層の密着強度 (g/15mm)
実施例1	酸素	6.7	0.01	50	140
実施例2	酸素	13.3	0.05	50	160
実施例3	酸素	23.3	0.10	50	180
実施例4	酸素	40.0	1.00	50	180
実施例5	酸素	56.7	2.00	50	180
比較例1	—	—	0	50	10
比較例2	—	40.0	1.00	50 大気導入直後真空蒸着	10
比較例3	—	—	1.00	50	20

Even if the metal vacuum evaporationo aluminium foil obtained according to examples 1-5 compared processing [which] so that clearly from Table 2, the result whose adhesion force of the copper vacuum

evaporationo film is improving greatly was obtained from the examples 1-3 of a comparison.
[0029]
[Effect of the Invention] In this invention, the grain size of a metal vacuum evaporationo layer serves as aluminium foil with which omission of a vacuum evaporationo layer were small improved compared with the thing without a vacuum evaporationo layer with a nucleus by carrying out sequential formation of a specific metal vacuum evaporationo layer with a nucleus and a specific metal vacuum evaporationo layer on aluminium foil. Therefore, it is effective in especially the aluminium foil copper vacuum evaporationo article that needs the adhesion reinforcement of the copper vacuum evaporationo film of this invention.

[Translation done.]